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THE INFLUENCE OF FOOD, BODY BUILD, AND SOCIAL ORIGIN ON THE AGE AT MENARCHE

BY LEA KRALJ-ČERČEK
Institute of Anthropology, University of Ljubljana, Yugoslavia

INTRODUCTION

IN girls, the first menstruation—menarche—is widely used as a criterion of sexual maturity, although it signifies neither the beginning nor the end of pubertal development.

The justification for the use of this criterion is the fact that ovulation or the formation and discharge of egg cells is closely connected—normally—with menstruation.

The wide range of variation in the age at menarche depends upon many factors. They are partly determined genetically, partly by the natural environment which acts upon the girl before menarche, especially climate and geographical location (Škerlj, '31 and '35; Wehefritz, '37; Gini and de Orchi, '39; etc.), and partly by factors to be found in the social environment.

MATERIAL AND METHODS

The investigated material was collected from girls at two secondary schools and from acqaintances, all of whom were born in the north-eastern region of Slovenia (Styria) where they also lived the majority of the time from birth until menarche.

For 223 girls examined, I obtained the exact dates of their menarches and, consequently, I could determine the exact age at menarche in years, months, and days. A questionnaire was formulated following Professor Škerlj's advice.

For comparison, particulars of 52 girls from 10.0 to 24.9 years of age on the island of Susak near Lošinj in the northern Adriatic were gathered and treated in the same manner.

RESULTS

The Mean Age at menarche.

The minimum age at menarche in this group is 120 months (10.0 years) and the maximum, 207 months (17.25 years). The calculated mean value at menarche in this group is:

$$M \pm m_M = 13.61 \pm 0.83 \text{ years}$$
$$\sigma \pm m_\sigma = 1.23 \pm 0.59 \text{ years}$$

a value between the limits of $M \pm \sigma$ is considered typical, in this case 12.38 to 14.84 years of age. Within these limits are 181 individuals or 81.1%. (In a completely normal distribution, 68.26% of all occurrences would be expected within these limits.)

The mean age at menarche of the present group is two months higher than the value ($M = 13.43$) obtained by Škerlj ('40) from 591 Slovenian secondary school girls. One of the reasons for this difference is probably that menarche occurs sooner in urban than rural areas. Perhaps the same reason accounts also for the later onset of menarche on the island of Susak, though one must not exclude other factors (low hygienic and bad social conditions, etc.), which very probably influence menarche. The mean age at menarche of 52 girls from the island of Susak is:

$$M \pm m_M = 13.94 \pm 0.17 \text{ years}$$
$$\sigma \pm m_\sigma = 1.235 \pm 0.122 \text{ years.}$$

The mean is 3.96 months higher than the mean for Styrian girls,

TABLE 1

The distribution according to the age at which menarche occurs, in months

AGE OF THE GIRL AT THE MENARCHE CALCULATED TO NEAREST MONTH	NUMBER OF GIRLS	AGE OF THE GIRL AT THE MENARCHE CALCULATED TO NEAREST MONTH	NUMBER OF GIRLS
120	1	165	3
123	1	166	6
129	1	167	8
132	3	168	16
133	2	169	6
136	1	170	4
140	2	171	5
142	3	172	4
143	1	173	6
144	6	174	6
146	3	175	3
148	6	176	2
149	3	177	4
150	5	178	3
151	3	179	2
152	5	180	5
153	3	181	3
154	4	182	3
155	2	183	1
156	18	187	2
157	9	188	1
158	4	189	1
159	10	190	1
160	8	191	1
161	4	192	4
162	4	202	1
163	4	207	1
164	2		
		Total.....	223

and 6.16 months higher than the mean ($M = 13.43$ years) found by Škerlj for secondary school girls in Ljubljana. Gound and Gould (cited after Hurlock, '49) found for a group of 680 girls at Louisiana State College exactly the same mean value ($M = 13.61$ years) which was calculated for our 223 Styrian girls.

TABLE 2

Accommodation of the distribution in years to the normal curve

CENTERED CLASSES IN YEARS	DIFFERENCE BETWEEN THE CENTERED CLASSES AND THE ARITHMETIC MEAN	RELATION BETWEEN THE DIF. (COLUMN 2) TO σ	ORDINATE AT x/σ	THEORETICAL FREQUENCY	OBSERVED FREQUENCY	DIFFERENCE BETWEEN THEORETICAL AND OBSERVED FREQUENCY	THE SQUARE OF THE DIFFERENCE BETWEEN THEORETICAL AND OBSERVED FREQUENCIES	AVERAGES OF THE SQUARE DIFFERENCE BETWEEN THEORETICAL AND OBSERVED FREQUENCIES
$\bar{X}$	$\bar{X} - M = x$	x/σ	a	$a \cdot \frac{N}{\sigma} = m$	m'	$m' - m$	$(m' - m)^2$	$\frac{(m' - m)^2}{m}$
10.5	—3.11	2.53	0.0163	2.96	4	—3.50	10.22	0.64
11.5	—2.11	1.72	0.0909	16.54	12			
12.5	—1.11	0.95	0.2541	46.25	40	—6.25	39.0	0.84
13.5	—0.11	0.09	0.3973	72.31	80	7.69	59.0	0.82
14.5	0.89	0.73	0.3056	55.62	61	5.38	29.0	0.52
15.5	1.89	1.54	0.1219	22.19	18			
16.5	2.89	2.35	0.0252	4.59	7	—1.27	1.62	0.063
17.5	3.89	3.16	0.0027	0.49	1			
Totals	.....			220.95	223			2.883

$\chi^2 = 2.883$, with 4 degrees of freedom $P = .58$

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10-
30-
50-
70-
90-
110-
130-
150-
170-
190-
210-
230-

Using the equation $y = 72.6xe^{-\frac{1}{2} \cdot X^2/1.5129}$, graph 1 shows the normal curve, the frequency distribution polygon, and the integral curve. The comparison of the polygon with the normal curve shows a good fit which is also confirmed by the theoretical curve on which the sums of the observed frequencies are distributed.

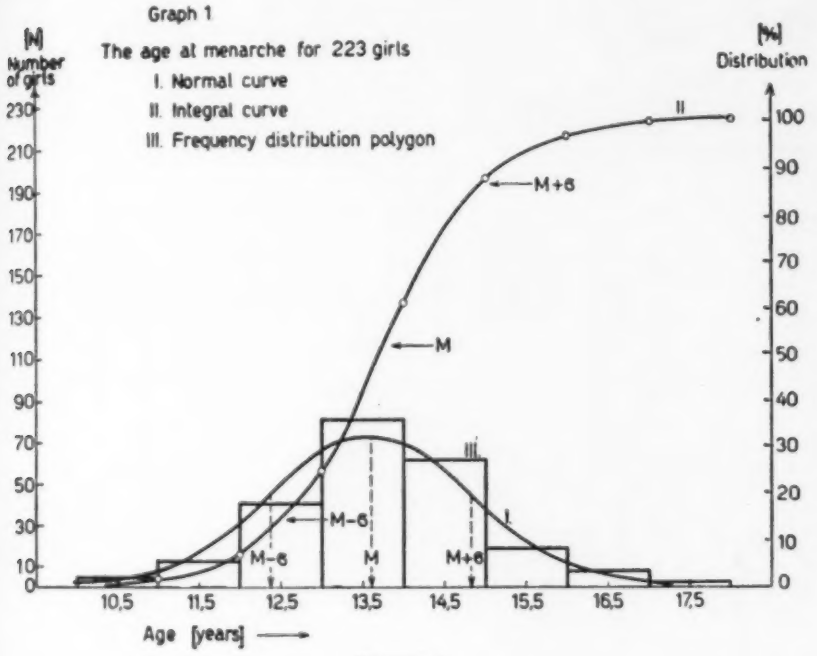

FIGURE 1.

Graph 2 represent the integral curve on Hazen's probability logarithmic paper, where the theoretical integral curve is a straight line, from which the probability of menarche in the group can be estimated to one-tenth of a year.

Influence of nutrition on the age at menarche.

As shown by Škerlj ('47) the age at menarche depends on the type of nutrition the girl had before menarche. To investigate the influence of nutrition, the 223 girls from northeastern Slovenia (Styria) and the 52 from the island of Susak were classified according to their nutrition into the following groups: proteinous, mixed, and carbohydratic.

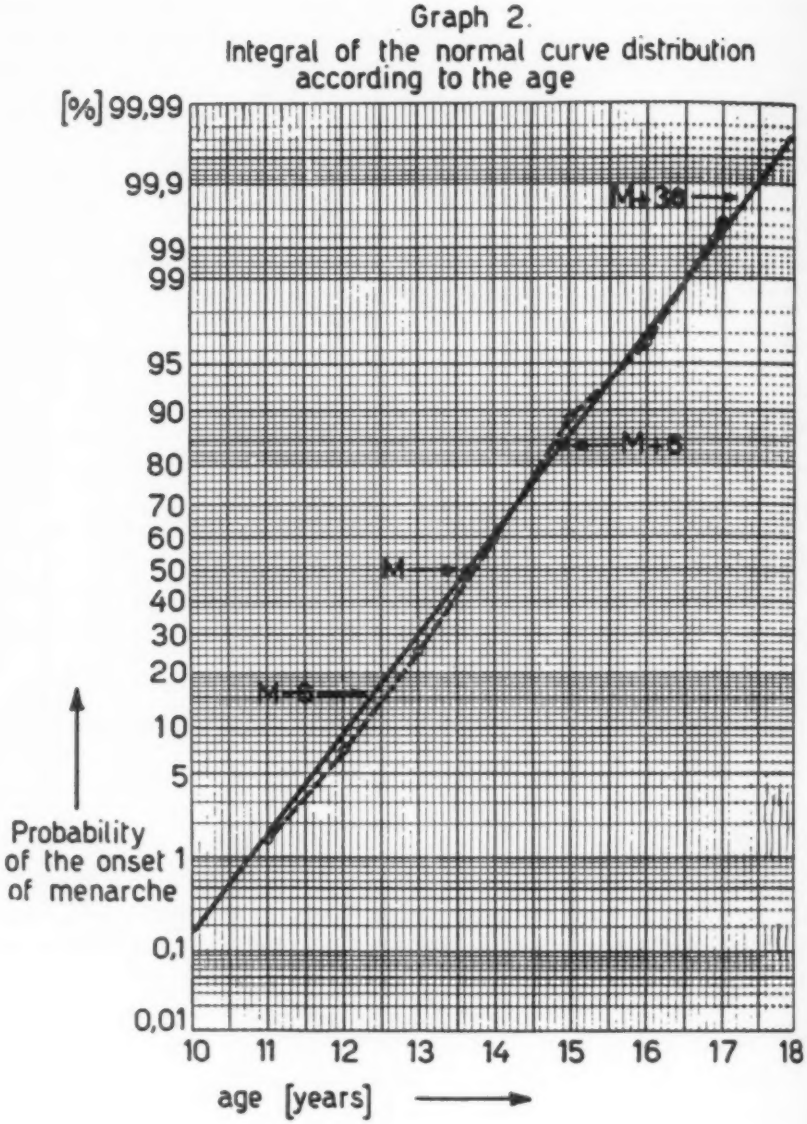
Graph 2.
Integral of the normal curve distribution
according to the age
[%] 99,99
99,9
99
99
95
90
80
70
60
50
40
30
20
10
5
1
0,1
0,01
M+3δ
M+δ
M
M-δ
Probability
of the onset
of menarche
10
11
12
13
14
15
16
17
18
age [years]

FIGURE 2.

The type of nourishment was marked on the form in answer to the questions and the girls' own classifications.

Among 223 girls, 45 ate proteinous, 75 mixed, and 103 predominantly carbohydratic food. The characteristics in table 3 show that the girls who ate predominantly proteinous food had their menarche sooner than girls who ate mixed, whereas those who ate carbohydratic food menstruated latest. The results are in accordance with Škerlj's assumption, that proteinous food has an influence on earlier menarche.[1]

The differenecs between the single groups are without a doubt characteristic since the "t" scores of the differences between the single groups, especially between the two extreme ones, are statistically significant.

Proteinous to mixed food: $t_D = 3.87$
Mixed to carbohydratic food: $t_D = 3.59$
Proteinous to carbohydratic food: $t_D = 8.13$.

TABLE 3

Characteristics of the age at menarche, in years, of the Slovenian girls, according to the kind of nutrition

PROTEINOUS	MIXED	CARBOHYDRATIC
number = 45	number = 75	number = 103
$M \pm m_M = 12.65 \pm 0.133$	$M \pm m_M = 13.42 \pm 0.145$	$M \pm m_M = 14.1 \pm 0.111$
$\sigma \pm m_\sigma = 0.88 \pm 0.094$	$\sigma \pm m_\sigma = 1.25 \pm 0.104$	$\sigma \pm m_\sigma = 1.6 \pm 0.080$

TABLE 4

Characteristics of the age at menarche, in years, of the Susak girls according to the kind of nutrition

PROTEINOUS	MIXED	CARBOHYDRATIC
number = 10	number = 17	number = 25
$M \pm m_M = 12.9 \pm 0.237$	$M \pm m_M = 14.1 \pm 0.297$	$M \pm m_M = 14.2 \pm 0.237$
$\sigma \pm m_\sigma = 0.73 \pm 0.163$	$\sigma \pm m_\sigma = 1.22 \pm 0.208$	$\sigma \pm m_\sigma = 1.15 \pm 0.163$

By using the same method of investigation, similar results (table 4) were obtained for 52 girls of the island of Susak.

[1] Škerlj classified the girls according to the weekly and daily frequencies of meat eaten. Girls who ate meat at least 7 times a week had their menarche at 12.83 ± 0.61, those who ate meat twice a day at 11.7 ± 0.74, whereas girls who ate meat only once a week had their menarche at 14.10 ± 0.25 years.

Menarche and body build.

An interesting factor is the girl's body build in relation to menarche. The girls were classified visually during gymnastic classes when they wore gym clothing:

1. Baroque: "pyknic," broad body build, feminine
2. Renaissance: "medium"
3. Gothic: "linear" or "boyish" type, angular

The mean values and other statistical characteristics are presented in table 5 from which it is evident that girls of the baroque type menstruate earlier than girls of the renaissance type, whereas the gothic type have the latest menarche.

TABLE 5

Age in years at menarche in relation to body-build of 223 girls

BAROQUE TYPE	RENAISSANCE TYPE	GOTHIC TYPE
number = 69	number = 97	number = 57
$M \pm m_M = 12.93 \pm 0.222$	$M \pm m_M = 13.5 \pm 0.104$	$M \pm m_M = 14.61 \pm 0.134$
$\sigma \pm m_\sigma = 1.29 \pm 0.089$	$\sigma \pm m_\sigma = 0.96 \pm 0.073$	$\sigma \pm m_\sigma = 0.95 \pm 0.089$

The difference between the single groups, especially between extreme groups, are statistically significant as shown by the following "t" scores:

Baroque to Renaissance type: $t_D = 2.33$
Renaissance to Gothic type: $t_D = 6.34$
Gothic to Baroque type: $t_D = 6.38$.

Škerlj *et al.* ('53) found in 1,709 girls that the "pyknic" or fat ones have the earliest menarche ($M = 12.99$ years) and that the leptosomatic girls ($M = 13.50$ years) mature later than the eurysomatic ones ($M = 13.36$ years). The medium ones, of "normo-type" mature the latest ($M = 13.66$ years). By comparing the values in table 5 with those of Škerlj it is evident that only the mean values for the pyknic type correspond. The reason for the difference in other types probably is the different method of body-typing.

On the island of Susak, girls are maturing according to their respective body build in the same order: 14 girls of the baroque type had their menarche at 13.40 ± 0.267 years; 21 girls of the medium type

at 14.05 ± 0.252 years, and 17 girls of the gothic type at 14.3 ± 0.326 years.

The differences are not as large as the mainland group but in spite of this, the "t" score between the two extreme groups is statistically significant:

baroque to gothic type: $t_D = 2.14$.

Influence of social origin.

The results, achieved by investigating the influence of social origin on the age at menarche, are in accordance with the findings of several authors (Škerlj, '50; Peller and Zimmermann, '32; Schreiner, '22; and others).

From the answers of the 223 girls and from my estimation according to the parents' vocations, the social enviroment was classified. The girls of good social origin had their menarche first, then the intermediate, and last the poor group.

TABLE 6

Age in years at menarche in relation to social status of 223 girls

GOOD	MEDIUM	POOR
number = 80	number = 123	number = 20
$M \pm m_M = 13.28 \pm 0.134$	$M \pm m_M = 13.71 \pm 0.104$	$M \pm m_M = 14.2 \pm 0.282$
$\sigma \pm m_\sigma = 1.195 \pm 0.089$	$\sigma \pm m_\sigma = 1.22 \pm 0.073$	$\sigma \pm m_\sigma = 1.24 \pm 0.193$

The "t" scores for the differences between the single groups are:

Good to medium social status: $t_D = 2.54$

Medium to poor social status: $t_D = 1.50$

Good to poor social status: $t_D = 2.51$.

The influence of social origin is evident also in the group of girls from the island of Susak. The differences between the single groups are, in spite of the small number, greater than those between the single groups presented in table 6. The "t" score for the difference between the good ($M = 12.9$ years) and medium ($M = 13.77$ years) group is $t_D = 2.67$, between medium and poor ($M = 14.5$ years) is $t_D = 2.25$, and between good and poor is $t_D = 5.08$.

Interestingly enough, it is impossible to claim that the social status

good corresponds to the proteinous, the medium to the mixed, and the poor to the carbohydratic nutrition; contrary to this, the type of nutrition is more or less uniformly distributed among the groups good, medium, and poor. Within the good group 25% of the girls ate proteinous, 32.5% mixed, and 42.5% carbohydratic food. In the medium group 22.4% of the girls ate proteinous, 27.8% mixed, and 49.8% carbohydratic food. In the poor group 25% of the girls ate proteinous, 25% mixed, and 50% carbohydratic food.

Consequently, one has to investigate the influence of social origin on the age at menarche as a separate factor and not identify the social origin with the kind of nutrition.

DISCUSSION

From the preceding, it is evident that various environmental factors, natural as well as social, influence the age at the menarche: nutrition, social conditions, and what may be called (with some reservation) "body build." If we were to investigate the influence of only one of these factors to estimate its "weight," we would have to eliminate all the others. If we do not do this, we negate the factors the influence of which we already admitted as proved.

The mean age at menarche (SM) may be presented as a mathematical function of the single parameters:

$$SM = f/O_k; (p, m, o); (b, r, g); (A, B, C); X/$$

O_k = influence of natural environment
p = proteinous food
m = mixed food
o = carbohydratic food
A = social status good
B = social status medium
C = social status poor
b = baroque type
r = renaissance type
g = gothic type
X = all up to the present unknown or unexplained factors, which should be put into the formula.

Since each girl within the investigated group ate more or less specifically one of the basic kinds of food, belonged to a distinct somatotype, and lived in a good, medium, or poor social condition, consequently, to investigate the dependence of the age at menarche on any one of the parameters, it would be mathematically incorrect not to fix all the others. Investigating the absolute "weight" of the effect

of nutrition, I find the solution of this function would be generally the following:

1. $SM' = f/(p);(b);(A)/$
$m=0;o=0;r=0;g=0;B=0;C=0;$
2. $SM'' = f/(m);(b);(A)/$
$p=0;o=0;r=0;g=0;B=0;C=0;$
3. $SM''' = f/(o);(b);(A)/$
$p=0;m=0;r=0;g=0;B=0;C=0;$

Since the entire group is from the same region (Styria), O_k is fixed; therefore, this factor has the same "weight" of effect on all the results: consequently, O_k is itself eliminated in the search for the differences between SM', SM'', SM''', *i.e.*, $O_k = 0$.

For the time being, the same may be assumed for the parameter X.

$SM'' - SM' = d_1$
$SM''' - SM'' = d_2$
$SM''' - SM' = d_3$

d_1 = difference due to the different influence of proteinous and mixed nutrition;
d_2 = difference due to the different influence of mixed and carbohydratic nutrition;
d_3 = difference due to the different influence of proteinous and carbohydratic nutrition.

Similarly the "absolute weight" of the influence of all other parameters could be obtained; there is a large number of possible combinations.

If we do not fix primarily the influence of nourishment, an error results from the effect of nutrition when investigating the body build's influence, which is shown in figure 3.

In the group of 233 girls from northeastern Slovenia differences already arise if we investigate the influence of the different kinds of nutrition within the group of girls of equal body build without respect to the social status to which the girls belong.: This may be seen from the results in table 7 in which, within the three fixed basic kinds of food, the influence of body build is to be found, and conversely.

The "t" scores of differences between the extremes confirm that these differences are statistically significant.

The "t" scores of differences between the extreme groups are:

$b_p - b_o$: $t_D = 3.54$
$r_p - r_o$: $t_D = 4.05$
$g_p - g_o$: $t_D = 7.43$
$p_b - p_g$: $t_D = 6.45$
$m_b - m_g$: $t_D = 6.64$
$o_b - o_g$: $t_D = 2.18$

TABLE 7

TYPE	PROTEINOUS	MIXED	CARBOHYDRATIC
Baroque	$M \pm m_M = 12.42 \pm 0.178$ years	$M \pm m_M = 12.45 \pm 0.208$ years	$M \pm m_M = 13.86 \pm 0.356$ years
	$\sigma \pm m_\sigma = 0.91 \pm 0.134$ years	$\sigma \pm m_\sigma = 0.91 \pm 0.134$ years	$\sigma \pm m_\sigma = 1.45 \pm 0.193$ years
Renaissance	$M \pm m_M = 12.87 \pm 0.193$ years	$M \pm m_M = 13.47 \pm 0.178$ years	$M \pm m_M = 13.79 \pm 0.119$ years
	$\sigma \pm m_\sigma = 0.77 \pm 0.134$ years	$\sigma \pm m_\sigma = 1.08 \pm 0.119$ years	$\sigma \pm m_\sigma = 0.77 \pm 0.089$ years
Gothic	$M \pm m_M = 13.6 \pm 0.000$ years	$M \pm m_M = 14.51 \pm 0.237$ years	$M \pm m_M = 14.7 \pm 0.148$ years
	$\sigma \pm m_\sigma = 0.0 \pm 0.000$ years	$\sigma \pm m_\sigma = 0.95 \pm 0.163$ years	$\sigma \pm m_\sigma = 0.93 \pm 0.104$ years

Since the intention of this paper is not to investigate the whole function, the possibilities and meaning of such a treatment has been shown by these examples. In considering the social status also, the parameters could have been arranged according to their "weight" of influence on the age at menarche.

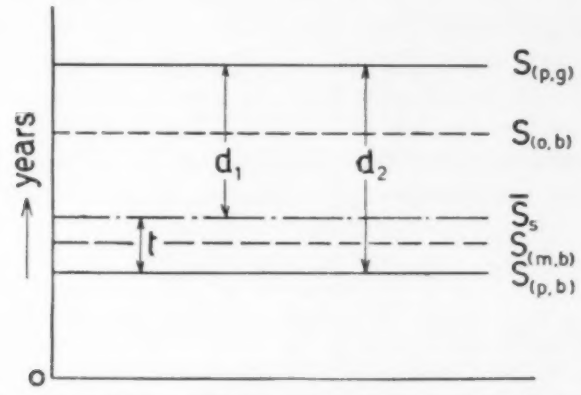

FIGURE 3. SCHEME SHOWING INFLUENCE OF NUTRITION ON ESTIMATION OF AGE AT MENARCHE ACCORDING TO BODY TYPE.

d_1 = difference in years between $S_{(p.g)}$, representing the mean value for the proteinous food for the gothic girls

S_s = the mean value resulting from the mean values of the sum:

$S_{(o.b)}$ = carbohydratic nutrition of the baroque type,

$S_{(m.b)}$ = mixed nutrition of the baroque type, and

$S_{(p.b)}$ = proteinous nutrition of the baroque type

d_2 = difference in years between $S_{(p.b)}$ and $S_{(p.g)}$, resulting only from the different types (baroque-gothic)

$d_2 - d_1 = \pm t$: error resulting from the influence of nutrition

CONCLUSIONS

The mean age at menarche of 223 secondary school girls in north-eastern Slovenia is 13.61 ± 0.83 years. It ranges from 10.0 to 17.25 years. Typically, these girls have their menarche between the age of 12 years and 4.6 months to 14 years and 10 months.

Nutrition markedly influences the rate of maturation; proteinous food accelerates, while carbohydratic nutrition inhibits the process. Former investigations of the hormonal glands show a close connection in the activity of the anterior lobe of the pituitary gland with sexual

glands. As known, the anterior lobe of the pituitary gland produces, among others, gonadotropical hormones which affect the sexual glands and stimulate them to increased activity. Up to the present there is no satisfactory explanation for the causes of the increased production in gonadotropic hormones and the sensitivity of the gonads for these hormones in a more or less specific period during puberty. Perhaps just the influence of nutrition, which may be an activator or inhibitor, may explain the above question on maturation. Only more extensive investigations of the endocrine glands by experimentation could perhaps give a satisfactory solution.

The results also show that body build has an influence on the age at menarche. Furthermore, the influence of social origin has been confirmed.

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COMPARISON OF PINCH-CALIPER AND TELE-ROENTGENOGRAMMETRIC MEASUREMENTS OF SUBCUTANEOUS FAT[1]

BY STANLEY MARION GARN AND EDWARD L. GORMAN

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INTRODUCTION

THE roentgenogrammetric and the pinch-caliper techniques of subcutaneous fat measurement are two presently competitive methods, each with its own particular advantages. The pinch-calipers are portable, self-contained and suitable for field use, but they compress the tissues to a still undetermined extent. Teleroentgenograms, on the other hand, permit the measurement of uncompressed single skin-plus-fat thicknesses, often at sites unsuitable for pinching, but the necessary apparatus is not always available (cf. Brožek and Keys, '50; Keys and Brožek, '53).

Since both of these techniques are used, and will continue to be used, it is of interest to determine first how well the results agree, and second, the extent to which the double fold is compressed, in reference to the uncompressed single thickness measured on teleroentgenograms. The present study, conducted on a selected sample of males with a narrow age range, and at a site ideal for both techniques, provides preliminary answers to both questions.

METHODS AND MATERIALS

Roentgenograms were taken and pinch-caliper measurements made on a total of 65 young adult males, all students at Antioch College. The age range was 21.0 to 22.9 years, and the weight range was 54 to 95 kg.

[1] The present study was supported in part by Contract 18(600)1566 with the Air Research and Development Command.

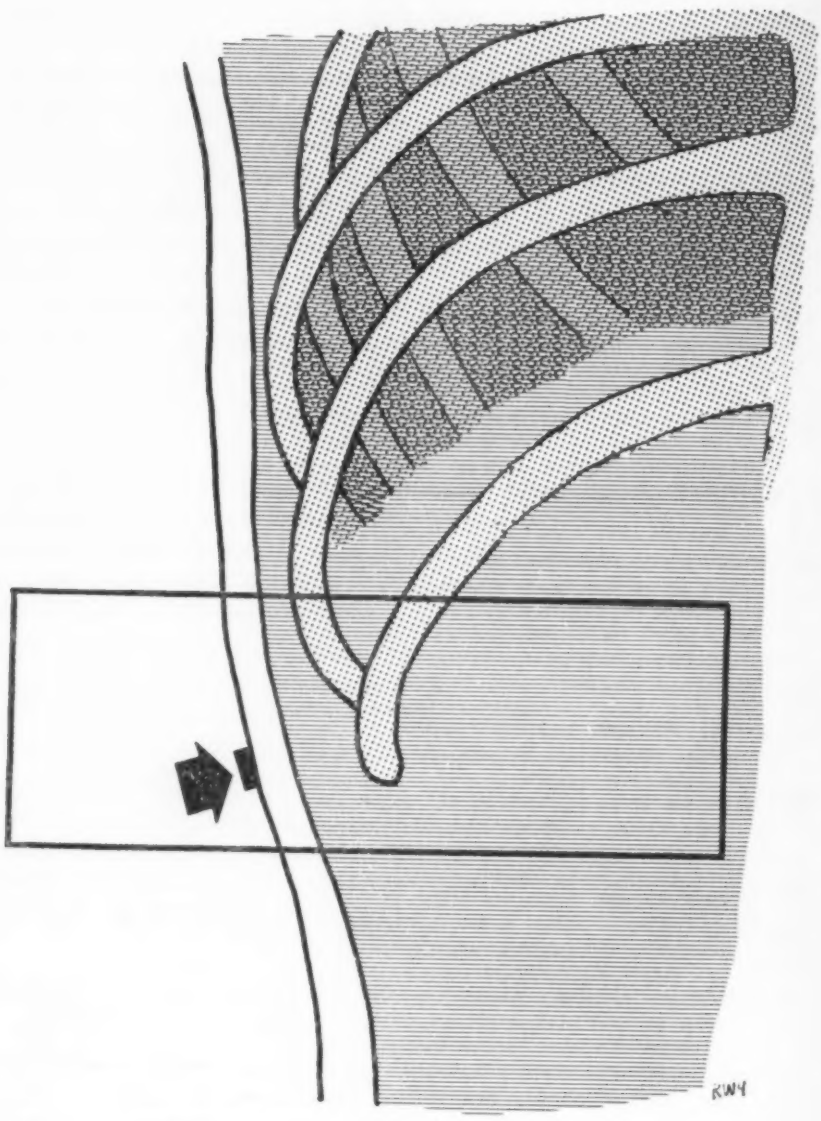

FIG. 1. The lateral thoracic section, traced from a postero-anterior chest roentgenogram, and showing (in the rectangular enclosure) the area actually included. The arrow points to the lead indexing dot, and to the skin-plus-fat thickness measured.

At the time of examination, the lower border of the left rib cage was located by palpation, and marked by a lead-rubber dot affixed at this level, but at the mid-axillary line. Then a true postero-anterior teleroentgenogram was taken of this section, with the central ray directed to the indexing dot. Finally, the lead-rubber dot was removed, and a double fat-fold measured, using a spring-loaded caliper equipped with jaws 30 square millimeters in area, and exerting a constant pressure of 10 grams per square millimeter.[2] The site measured, which is designated as "lower thoracic," apparently corresponds to chest site no. 4 pictured by Edwards ('50). It is close to the "waist" measurement (no. 5) used by Škerlj *et al.* ('53, p. 580) but is well removed from the chest-fat measurement employed by Newman ('52).

The thickness of a single fat-plus-skin layer was measured at the indicated point on the radiographs at right angles to the skin surface, using a vernier micrometer with ground tips (Garn and Saalberg, '53). Details of the radiographic and roentgenogrammetric procedure otherwise follow Garn ('54). The location of the measurement (lower thoracic fat) is shown in fig. 1, which is a tracing of an x-ray section used in the present study.

FINDINGS

As shown in fig. 2, the two sets of measurements exhibit a fairly high degree of correlation ($r = 0.88$), and the relationship between the two appears to be reasonably linear, since the correlation ratio (ρ) is not notably higher than the product moment correlation (r). The roentgenogrammetric single-thickness measurements and the pinch-caliper double-thickness measurements both exhibit moderate correlations with weight ($r = 0.58$ and 0.48 respectively). Both techniques appear to provide equally good indications of body fat.

Analyses of the two distributions show them to be comparable in form. As would be expected, both are highly skewed, with a long tail to the right. The Pearsonian coefficient of skewness (SK) is 0.86 for the roentgenogrammetric measurements, and 0.79 for the pinch-caliper measurements. The pinch-caliper measurements are somewhat larger (median 12.0, mean 13.9) than the x-ray measurements (median 9.3, mean 11.1).

[2] The pinch-calipers used were constructed by the Yellow Springs Instrument Company, and were modified from a design by the Laboratory of Physiological Hygiene, University of Minnesota. Dr. Brožek's recommendations on jaw area and pressure were followed.

Since the pinch-caliper measurements are considered to represent a compressed *double* fold, it is therefore necessary to compare these values with twice the uncompressed value as computed from the means. The pinch-caliper values average 63% of the theoretical uncompressed double thickness while the median is 65% of the theoretical uncompressed

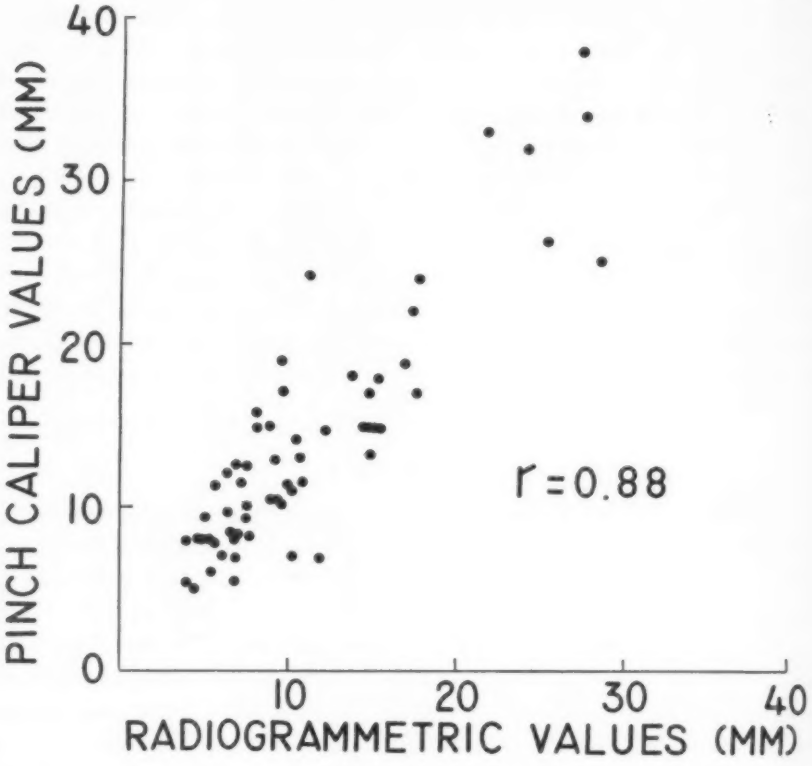

FIG. 2. Scattergram showing the relationship between the teleroentgenogrammetric measurements (abscissa), and the pinch-caliper measurements (ordinate) of the lower thoracic fat. For 65 young adult males aged 21–22 years, the obtained r is 0.88.

double thickness. Corrected for x-ray enlargement (due to divergence of rays), the pinch-caliper values thus average approximately 70% of their true uncompressed thickness along the full scale.

Assuming then, that there is a 30% reduction in thickness due to compression, the corrected pinch-caliper measurements, and the com-

puted theoretical double folds closely agree. Apparently the percentage reduction is consistent in the range 6–60 mm as shown in table 1.[1]

The closeness of the two distributions is further shown by the high degree of correspondence between paired values. The mean difference was 0.2 mm with a standard deviation of 1.1 mm. The largest discrepancy between an observed and "calculated" double-fold was 3.8 mm.

TABLE 1

Comparison of corrected pinch-caliper values with true double-fold thickness

CLASS INTERVAL (MM)	TRUE DOUBLE-FOLD THICKNESSES [1]		CORRECTED PINCH-CALIPER THICKNESSES [1]	
	No.	%	No.	%
0– 5.9	0	0.0	0	0.0
6–11.9	11	18.0	8	13.1
12–17.9	17	27.9	22	36.1
18–23.9	13	21.3	14	23.0
24–29.9	5	8.2	8	13.1
30–35.9	9	14.8	1	1.6
36–41.9	0	0.0	4	6.6
42–47.9	1	1.6	0	0.0
48–53.9	2	3.3	3	4.9
54–59.9	3	4.9	1	1.6
60–65.9	0	0.0	0	0.0

[1] Roentgenogrammetric values × 2.0, Pinch-caliper values × 1.54
Medians 18.6 and 18.6 mm respectively.

DISCUSSION

It is evident from these findings that the two techniques compared here agree surprisingly well, thus confirming Baker's findings which relate to leg and arm fat thickness (Baker, '55). In fact, the true correlation in the present study may be expected to exceed 0.90 or even 0.95, since attenuation was not taken into account. Naturally, comparable degrees of agreement should not be expected for dorsal or ventral sites (which are less easily measured on teleroentgenograms), or pelvic sections where the subcutaneous tissue is firmly attached to the deep fascia (*cf.* Edwards, '50, p. 260). The lower thoracic site was specifically selected for study, because it pinched well and x-rayed well (Garn, '56).

Clearly, pinch-caliper measurements at this site, where the underlying fat is rather loosely structured, fall short of the calculated true or uncompressed double-fold. At 10 grams/mm² pressure, with a 30 mm² jaw area, the 300 gram force reduces the double fold approximately 30% along the full range of thicknesses encountered. Similar results were obtained, using a slightly different pinch-caliper on 20 of the 65 subjects, indicating that the exact form of the instrument is not a determining variable.

Practically, then, pinch-calipers may be substituted for radiographs, if the lower thoracic section is measured, and if the results are utilized on a group basis. Further, pinch-caliper thicknesses may be corrected to uncompressed values, or made comparable to single uncompressed thicknesses, by applying the proper constant. Additional studies are necessary, however, before these findings can be applied to other fat sites, and to other age groups, and especially to grossly obese individuals where uncompresed lower thoracic fat thicknesses may exceed 60 mm, and even more.

SUMMARY

1. Roentgenogrammetric and pinch-caliper measurements of the fat-plus-skin thickness at the lower thoracic region at the mid-axillary line were compared.

2. For 65 young adult males, aged 21 and 22 years, the correlation between the two sets of measurements was 0.88.

3. While the two distributions were of comparable form and degree of skewness, the "double skinfolds" averaged 70% of their calculated true value, indicating 30% reduction due to tissue compression under a total force of 300 grams.

ACKNOWLEDGMENTS

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HYPERTROPHIC PYLORIC STENOSIS IN THE SOUTH AFRICAN BANTU

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THE finding of what is believed to be the first reported case of hypertrophic pyloric stenosis in a South African (Negro) infant raised the question whether an analysis of this condition in Negroes might cast light on its etiology. Emotional and environmental factors may be significant in the etiology of a condition rare in African as compared with American Negroes.

THE CASE

A typical case of hypertrophic pyloric stenosis in a one month old male Bantu infant was seen in September, 1954. His mother was of the Moroleng tribe, his father a Xosa. The diagnosis was confirmed at operation. Incidentally, the mother had been much worried throughout the pregnancy and post-partum period.

THE INCIDENCE OF HYPERTROPHIC PYLORIC STENOSIS IN JOHANNESBURG

Since this is the first reported case in a full blooded Bantu, and the disease appears to be so rare among non-white South Africans, an attempt was made to determine its incidence among all races in Johannesburg.

Table 1 shows the incidence of pyloric stenosis among Europeans and non-Europeans admitted to hospital. For non-Europeans there are few other hospital facilities, and it can be expected that nearly all cases reach the two hospitals shown. However, for Europeans there are many private nursing homes, and the number of cases shown in table 1

TABLE 1

The incidence of pyloric stenosis in Johannesburg in 1954 among children in hospital

HOSPITAL	TOTAL ADMISSIONS	NO. OF CASES	CASES PER 1,000 ADMISSIONS
Transvaal (European) Memorial Hospital	4,029	14	3.47
Baragwanath Non-European Hospital	4,922	2	0.41
Coronation Non-European Hospital	2,211	1	0.45

is probably lower than the true incidence among hospitalised European children. The number of cases seen in 1954 at the Transvaal Memorial Hospital was lower than in preceding years: in 1952 there were 17 cases and in 1953, 19 cases.

The two cases seen at Baragwanath Hospital were both proved at operation; one was Bantu and the other of mixed racial origin. Symptoms suggestive of pyloric stenosis were seldom seen in the 64,000 out-patient visits made to the hospital by children in 1954. The single case seen at Coronation Hospital was Bantu and was treated medically.

TABLE 2

Births and infantile deaths and incidence of pyloric stenosis in Johannesburg in 1953-1954 *

RACE	NO. OF REGISTERED BIRTHS JULY 1953 TO JUNE 1954	HOSPITAL CASES OF PYLORIC STENOSIS JULY 1953 TO JUNE 1954	NO. OF REGISTERED INFANTILE DEATHS 1953-1954	NO. OF DEATHS DUE TO PYLORIC STENOSIS 1953-1954
European	8,570	11	253	2
Eurafrican and Asiatic	2,456	1	164	1
Bantu	12,580	0	1,778	—

* The period covered by this table differs from that in table 1.

This hospital serves more Eurafricans and Asiatic patients than Baragwanath and has previously seen two or three cases of pyloric stenosis yearly, but the patients were not pure Bantu. The two Bantu cases for 1954 were the first ever seen at these Johannesburg hospitals.

The number of deaths shown in table 2 represent death certificate notifications. None of the hospital cases died, so the deaths due to pyloric stenosis represent additional cases. This table again demonstrates the rarity of pyloric stenosis among the Bantu.

DISCUSSION

The incidence of pyloric stenosis in the South African urban Bantu appears to be very low. Are cases being missed? It is realised that the recorded incidence of pyloric stenosis of infancy rises with the standard of medicine practised in the area. In Johannesburg, medical services for the Bantu are sufficiently developed to prevent many cases from being missed. The city contains a university medical school and three teaching hospitals. Baragwanath hospital provides radiological and laboratory facilities and has 7 specialist pediatricians in full-time employment. It is known that Bantu mothers readily avail themselves of the services provided by hospitals and clinics (Higginson *et al.*, '54) and 54% of registered Bantu births attend infant welfare clinics provided by the City Health Department, where qualified Health Visitors and Child Welfare Medical officers are employed (Griffiths, '54).

The incidence of pyloric stenosis in England, according to Davison ('46) is three cases per 1,000 children born, and in Gotëberg in Sweden Wallgren ('41) found one case per 250 births. On the basis of these figures Bantu cases should number at least 37 to 50.

In Johannesburg amongst whites the incidence of pyloric stenosis is probably similar to Davison's English figures. The number of cases for the year recorded in table 2 is 13, whereas the expected number is approximately 25. This is almost certainly due to the fact that cases were seen by private practitioners and not admitted to public hospitals, especially as in Johannesburg medical rather than surgical treatment is favoured among some pediatricians.

The hospital incidence overseas is very much higher than the Bantu hospital incidence, but similar to the city's European incidence, as in the Milwaukee Children's Hospital, where one in 213 admissions had pyloric stenosis (Schaefer and Erbes, '48). In Edinburgh, at the Royal

Hospital for Sick Children, the incidence is even higher than this with 13.7 cases per 1,000 admissions in 1951 (Nicholson, '53).

Is the low incidence in the Bantu a characteristic of negroid races? It would appear that pyloric stenosis is now more frequent in American Negroes than it used to be.

Ward ('27) reviewing the literature, found no cases amongst them before 1927. Bakwin in 1932 stated that pyloric stenosis was rare in Negroes. However, from 1916 to 1936 at the Charity Hospital for New Orleans, 30% of 76 cases were Negroes, although this figure was a little lower than might have been expected for the number of Negroes amongst general admissions to the hospital (Romano and McFetridge, '38). At the Boston City Hospital, of 41 cases submitted to operation between 1949 and 1952, 8 were Negro children (English *et al.*, '54).

American Negroes do not trace their ancestry to the same part of Africa as those of Johannesburg, among whom, as previously noted, pyloric stenosis is rare. However, in other parts of Africa such as Rhodesia (Gelfand, '48) and Belgian Congo (Wallgren, '41) the condition is also apparently seldom seen. In Rhodesia Shepherd-Wilson and Gelfand ('55) published an account of the first case which they had seen in an African infant. Their patient was admitted in October, 1954, and the diagnosis confirmed at operation.

If the figures for American Negroes reflect a true increase in the incidence of pyloric stenosis, the question arises as to whether environmental factors may be responsible. There is already evidence that psycho-somatic factors play a part in pyloric stenosis. Powers ('53) surveyed the emotional background of pregnant and parturient mothers of infants with pyloric stenosis, chosen at random over a 10 year period. He found that the majority of the mothers were nervous or tense during the pregnancy and immediate post-partum period. However, his survey was small, and apparently without controls.

Sontag ('41) stated he had observed a relationship between pre-natal stimulation and some of the early feeding difficulties of infants. He suggested that prolonged nervous and emotional disturbances of the pregnant mother might produce an irritable and hyperactive autonomic nervous system in the foetus.

A follow-up study on individuals who suffered from hypertrophic pyloric stenosis in their infancy showed a high incidence of peptic ulcer, ulcerative colitis and highly strung, unstable personalities (Bendix and Necheles, '47).

Amongst the Bantu the so-called psycho-somatic diseases are rare, and possibly this is the reason why hypertrophic pyloric stenosis is seldom encountered.

That the condition is congenital now appears unlikely, and Wallgren ('46) showed that 5 male neonates who later developed clinical and typical radiological signs of pyloric stenosis, had pyloric canals which were completely normal radiologically shortly after birth. Pyloric stenosis is extremely rarely found at post-mortem on prematures and still-births (Nicholson, '53).

The work of McKeown, McMahon and Record ('51a, '51b, '52) has shown that post-natal environment is important in the aetiology. A great change is taking place in the environment of the South African Bantu people. There is a shift to the cities, and here all the strains and stresses of Western European Civilisation are found. The standard of living is being raised, and education, including university education, is becoming available on a rapidly increasing scale. If such environmental factors are responsible for the appearance of the disease in American Negroes, an increase in the incidence of hypertrophic pyloric stenosis, at any rate in the urban Bantu population, may be anticipated in South Africa.

SUMMARY

(1) A case of hypertrophic pyloric stenosis in a South African Bantu infant, confirmed at operation and believed to be the first recorded is reported.

(2) Figures for the incidence of this disease in Johannesburg in 1953-1954 are given, and discussed, and it is concluded that pyloric stenosis is extremely rare in the urban Bantu.

(3) The apparent increase of this disease in the American Negroes is mentioned, and it is suggested that environmental and psycho-somatic factors may be responsible.

(4) It is suggested that an increase in the incidence of pyloric stenosis may be anticipated in the urban South African Bantu.

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THE INCIDENCE OF SIX ANOMALIES OF THE TEETH AND JAWS *

BY MEYER KLATSKY

THE anthropological division of the American Museum of Natural History, New York, is a repository of large collections of ancient and modern skulls suitable for the study of the incidence of dental anomalies. I have chosen 25 groups for whom large numbers of suitable skulls were available and have examined a total of 8,328 skulls. I have investigated six anomalies of the jaws and teeth, namely, torus palatinus, torus mandibularis, supernumerary teeth, naturally missing teeth, reduced teeth, and impacted teeth. I duly recorded each one of the above anomalies, when found in a skull, and present herewith a general summary (tables 1 and 2).

TORUS PALATINUS

Torus palatinus is an abnormal osseous growth in the midline of the hard palate. It may vary in size and form and, while it is non-pathologic, it may interfere with the fitting of a denture when such is required. In recording this, as well as the other anomalies, I eliminated all indistinct and doubtful cases, confining the count to only well developed structures and abnormalities. I found torus palatinus in 18 of the 25 groups examined, totalling 482 cases. It has great prevalence among non-Europeans, but it also affects some Europeans. I found 24 cases of torus palatinus in the 493 German skulls, 60 cases in the 932 Hungarian skulls, and 173 cases in the 1200 Austrian skulls which I examined.

In reporting on torus palatinus, Berger ('52) stated that "it was

* Abstracts of this paper were presented before the New York Section of the International Association for Dental Research, February 28, 1956 and before the 25th Annual Meeting of the American Association of Physical Anthropologists in Chicago, April 8th, 1956.

TABLE 1

Incidence of jaw and tooth anomalies within groups

GEOGRAPHIC GROUP	NO. OF SKULLS	TORUS PALATINUS	TORUS MANDIBULARIS	SUPERNUMERARY TEETH	MISSING TEETH	REDUCED TEETH	IMPACTED TEETH
New Britain	230	0	0	3	25	18	1
Egypt	485	0	0	2	86	15	7
Australia	50	1	0	0	3	3	0
China	52	0	0	0	4	0	0
Asia Minor	300	6	0	0	12	3	6
India	94	0	0	2	16	4	1
Greece	343	5	0	0	10	2	1
Malay Peninsula	94	0	0	0	4	0	0
Germany	493	24	0	2	55	5	10
Hungary	932	60	0	3	113	14	14
Austria	1,200	173	1	5	128	0	23
Peru	430	9	0	2	58	5	11
Eskimo	222	21	18	0	39	14	2
British Columbia	540	44	13	1	55	5	10
Bolivia	875	46	5	4	94	4	6
Mexico	616	11	6	5	104	8	28
Alaska & Aleutian Islands	50	12	3	0	8	5	0
Washington	200	22	0	3	14	3	5
Oregon	61	7	0	0	6	0	0
Kentucky	83	0	0	2	3	3	3
Utah	200	17	8	2	20	0	6
California	32	5	1	0	7	3	0
Colorado	64	1	3	0	4	2	3
Arizona	232	11	12	2	21	6	11
New Mexico	450	7	19	3	58	7	9
TOTALS	8,328	482	89	41	947	129	157

TABLE 2

Distribution of tooth anomalies

		SUPERNUMERARIES	MISSING	REDUCED	IMPACTIONS
Central incisors	upper	21	0	0	*
	lower	2	2	1	0
Lateral incisors	upper	5	33	16	*
	lower	1	0	0	0
Canines	upper	0	1	0	38
	lower	0	1	0	8
Permolars	upper	3	2	0	1
	lower	3	2	0	0
Third molars	upper	—	571	94	30
	lower	—	335	15	48
Fourth molars	upper	3	—	—	—
	lower	3	—	—	—

* 32 in upper incisor region including many supernumeraries.

not clear whether the growth is a developmental anomaly, exostosis, or whether it is an osteoma in the oncologic sense." The consensus among geneticists is that torus palatinus is an abnormality of hereditary nature. Lasker ('47) found only one instance of a discordant pair among 13 pairs of homozygous twins. He also suggested that torus palatinus resulted from "an autosomal dominant inheritance in some instances" (Lasker '50).

TORUS MANDIBULARIS

Torus mandibularis is a bony growth on the lingual surface of the lower jaw usually found bilaterally in the premolar region. It may vary in size, often extending far into the molar area, and it may also be found only unilaterally. Torus mandibularis occurs less frequently than torus palatinus. I found this anomaly in only 11 of the examined groups, notably the Eskimos, the Aleutian Islanders, and some of the American Indian tribes, a total of 89 cases. Weidenreich ('36) called attention to the occurrence of this trait in Sinanthropus mandibles. While torus mandibularis and torus palatinus may be found in the same specimen, in most of the cases they are dissociated and must be considered as separate entities. Hrdlička ('40) and Hooton ('18) suggested the occurrence of these tori as being caused by the hyperfunctional activity of the masticatory apparatus, which is characteristic of many non-Europeans, but some geneticists classify torus mandibularis, like torus palatinus, among the hereditary abnormalities.

SUPERNUMERARY TEETH

The occurrence of supernumerary teeth was investigated and reported by many dentists and anthropologists including Black ('09), Bolk ('14), Stafne ('32), and others. Colyer ('36) made an extensive study of this and other anomalies in the animal kingdom. Reporting on supernumerary teeth in the primates, Colyer found 147 extra teeth in a total of 11,042 skulls which he examined, giving a percentage of 1.3. This is a much higher percentage than most investigators found in the human mouth, even exceeding the highest estimate in the human given by Stafne ('32). Stafne examined 48,550 patients with the use of the X-ray, and found 441 cases of one or more supernumerary teeth, an incidence of 9.1 per 1,000, or one for every 110 persons.

I found only 41 supernumerary teeth in a total of 8,328 skulls examined. However, this low count may be accounted for by the many

broken and edentulous maxillary and mandibular specimens in the collection. These, while suitable for the study of other anomalies, proved to be inadequate for an exact count of supernumerary teeth. Stafne's results must therefore be accepted as the more conclusive.

What causes supernumerary teeth? In the past, this phenomenon was explained as an indication of atavism, or the recurrence of characters of remote ancestors, in conformity with the theory of recapitulation which was advanced by Haeckel many years ago (1875), implying that phylogeny anticipates ontogeny, and that adult ancestral stages are automatically pressed back into the individual development of later descendants. This theory has been disproved by de Beer ('51) and others who have shown that phylogeny is not the cause, but rather the result of ontogeny. Abnormal characters first appear in the individual as mutations. The mutant genes responsible for such dental anomalies as supernumerary teeth, and others, may become fixed, establishing themselves in the human race as well as the rest of the animal kingdom. The hereditary nature of the above and many other dental anomalies was pointed out by Keeler ('35), Lasker ('50), and other researchers.

MISSING TEETH

The incidence of genetically missing teeth is greater in man than in other animals. In making comparisons of missing with supernumerary teeth among the anthropoids, Colyer ('36) reported: in the gorilla, 4.4% of extra teeth and 0.6% of absent teeth. In the chimpanzee, he found 2.9% of extra teeth as compared with 1.6% of absent teeth. In the orang-utan, 6.8% of extra teeth and 2.4% of missing teeth. In the gibbon, 0.7% of extra teeth and 3.6% of absent teeth. This shows that, with the exception of the gibbon, where extra teeth are very rare, anthropoids show a small proportion of absent to supernumerary teeth. The opposite is the case in man, the proportion of naturally missing teeth being far greater than that of supernumerary teeth.

In my examination I found genetically missing teeth in all the 25 groups, a total of 947 teeth (see table 1). It would be unscientific, however, to apply the above as the exact statistical proportion of missing teeth to all mankind. In the final tabulation of his animal studies, Colyer omitted the cases showing absence of teeth from his table "as their determination is, in many cases, rendered difficult owing to the possible loss of the teeth from injury." The clinical study of missing

teeth in the human is not any easier because of the frequent loss of teeth due to caries or other causes, making it difficult to distinguish between naturally and artificially missing teeth. This acounts for the discrepancies encountered in the reports on studies of this nature by different investigators.

The frequency of missing teeth, especially those of third molars and upper lateral incisors, in the mouth of man attracted the attention of numerous researchers, including Schultz ('32), Goldstein ('32), Hellman ('36), Dahlberg ('37), Montagu ('40), Brekhus *et al.* ('44), Pedersen ('47), Mandeville ('49), Rushton ('53), and others. It is within the realm of the genetically minded medical man and dentist to investigate the subject more thoroughly. Is the phenomenon of naturally missing teeth an abnormal trait or a different variation within the range of normality? Is this deviation from the normal tooth formula due to a reshuffling of normal genes, or are mutant genes responsible for it? The geneticist Stern ('49) points out that "the difference between normal and abnormal is particularly significant from the point of view of medical men and those psychologists who are interested in the inheritance of mental defects; the differences between normal variants concern the anthropologists and those psychologists who investigate the normal variability of mankind."

Some geneticists tend to consider absent teeth as variations within the limits of normality. For example, in their book, *Human Heredity*, Neel and Schull ('54) are discussing certain variations in organisms which may be influenced by both heredity and environment. According to these authors variation in the number of bristles in the *drosophila* may be due to such environmental factors as differences in diet or temperature. Proceeding to compare variations in the number of bristles in flies with variations in the number of teeth in man, they make the following statement: "Some individuals lack one or more incisor teeth, others lack third molars, and some few develop no teeth at all. These are in part inherited but are in part due to the occurrence of certain types of illness or dietary deficiencies at certain periods in the development of the tooth."

By partly attributing tooth absence to environmental factors, the authors automatically imply that this variation belongs more to the domain of modifications than of mutations. In differentiating these terms, the geneticist Schmalhausen ('49) says: "Mutations are always new acquisitions of the organism, while modifications are merely a

superstructure or a new version of the already existing organization." Dental deficiencies like complete or partial absence of teeth have been studied by Brodie *et al.* ('42), Brekhus *et al.* ('44), Grant and Falls ('44), Ellis ('46), Sealey ('46), and others. They all seem to agree that anodontia and oligodontia are caused by a detrimental mutant gene for the sex-linked anhidrotic ectodermal dysplasia. Individually missing teeth undoubtedly are also a product of genetic changes originating as phenotypic expressions of mutant genes.

REDUCED TEETH

Reduction in the size of some teeth is also a common occurrence. The teeth and their development are controlled by a gene complex, an aggregate of numerous genes. Some of these presumably give expression to the dental apparatus as a whole, while others control each tooth separately, as every tooth is an independent organic unit. The pattern, size, and shape of each tooth are also regulated by different genes and gene modifiers. Tooth quantity is governed by multiple factors. It is therefore reasonable to believe that when a phenotypic change in the size or form of a tooth occurs it must be due to an alteration in one or more of the gene modifiers, as distinguished from those genes which are responsible for the formation of the tooth.

Some teeth are more susceptible to reduction than others. Dahlberg ('49) divided the dental formula into stable and variable teeth. The lower central incisors, upper lateral incisors, the second premolars, and second and third molars are the unstable teeth. They often develop in reduced size and abnormal shape. The degree of reduction of these teeth may also vary.

In examining the skulls, I only recorded those cases which showed extreme reduction, *i.e.*, limiting myself to peg-shaped teeth. I found a total of 129 such teeth in my collection (see tables). Other researchers who included slight abnormalities naturally found much greater numbers of reduced teeth in the human mouth.

IMPACTED TEETH

Dental impactions constitute a problem of major practical importance to the dentist. Much has been written on the diagnosis, prognosis, and surgical removal of unerupted or impacted teeth, but very little is known about their etiology. The sparse material published on the causes of dental impactions is more of a speculative than of strictly

scientific nature. There is a common belief that the failure of some teeth to erupt is characteristic of modern man with his small jaws, which do not allow ample space for all the teeth to erupt. But tooth impactions do occur in large as well as in small jaws. There is a great incidence of this anomaly among ancient and non-European peoples with fully developed, compact jaw-bones and teeth. Ancient peoples and modern tribes, such as the Egyptians and the American Indians, who are known for their well-developed masticatory organs show a high incidence of impacted teeth (see tables). The prehistoric Mousterian youth had an impacted lower left permanent canine.

Elsewhere ('53), I have reproduced dental roentgenograms of an 82 year old woman with both her upper canines impacted. Her jaw-bones are fully developed. She still retains most of her good teeth, and large natural spaces between the upper lateral incisors and pre-molars that could well accommodate those canines are much in evidence. In spite of all this her canines still remain unerupted.

The nearest approach to the solution of this problem was reported two decades ago by Hellman ('36), a dental anthropologist. He found that the occurrence of tooth impaction was generally associated with retardation of the growth of the face. He coupled third molar impactions with their absence, linking both phenomena to the process of organic evolution. He concluded that "there is a trend in human evolution to suppress the third molar teeth, and that this occurs in two ways: one is by delaying their eruption indefinitely and the other by eliminating them entirely." He does not hazard an opinion whether tooth impaction is caused by environmental or by hereditary factors, but by linking it with the physiological process of growth and development he seems to me automatically to relegate it to the domain of heredity. If we are to associate tooth impaction and tooth absence with evolution we must necessarily realize that both abnormalities are of genetic nature.

So far, there has been very little evidence published to show the true genetic nature of dental impactions. Most experimentation in genetics has been performed on toothless animals and plants. The human being is a poor subject for this kind of experiment. The only mention of tooth impaction as being associated with genic abnormality is by Snyder ('51), who reported: "In cattle, for example, we have discovered in our laboratory a recessive gene which is lethal. In the homozygous condition it produces calves with an abnormal lower jaw,

in which the lower teeth are impacted." All indications are that tooth impaction, like the other dental anomalies discussed above, are the result of similar genetic alterations.

SUMMARY

The human teeth and jaws are subject to various anomalies or abnormalities of genetic origin. The incidence of six anomalies which lend themselves most readily to study by means of skull examination was studied. A total of 8,328 skulls belonging to 25 geographically arranged groups were investigated. Torus palatinus was found in 18 of these groups, both ancient and modern, totalling 482 palates. Torus mandibularis was found in 89 mandibles of 11 groups, mostly non-Europeans. The occurrence of supernumerary teeth was limited to 14 groups, totalling 41 teeth. A total of 947 naturally missing teeth, mostly third molars, were found among all the 25 groups. Reduced teeth were found in 20 groups, totalling 129 teeth. One hundred fifty-seven impacted teeth, mostly third molars and canines, were found in 19 groups, affecting Europeans and non-Europeans alike.

ACKNOWLEDGMENT

I am indebted to Dr. H. L. Shapiro, chairman of the Department of Anthropology, American Museum of Natural History, for granting me permission to study the skulls and for all his invaluable aid which made this research possible.

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BOOK REVIEWS

Medical Research: A Midcentury Survey. Edited by ESTHER E. LAPE. Vol. I. American Medical Research. xxxii + 765 pp. Vol. II. Unsolved clinical problems. xxxii + 740 pp. Little, Brown and Co., Boston, for the American Foundation, New York, 1955. $15.00.

It is not a mere coincidence that the adjective "fascinating" has been used by at least two previous reviewers in their evaluation of this publication. For "fascinating" is, in fact, the term that best characterizes this large work. The first volume deals with the principles and practice of medical research, and is particularly relevant for students of human biology. The introduction, describing why and how the study was made, is followed by four sections entitled Medical research in perspective of current biological, chemical, physical and mathematical science, The current trends and current problems in biological and medical research in the United States, The research agencies, and Clearing results and controlling products of medical research.

There is such a wealth of information contained in these 700-odd pages that practically no relevant aspect of broadly conceived medical research or of medical education is not covered. Yet the sound basic philosophy underlying the presentation of details seems to be still more important. The book develops the thesis that medical progress is the outcome of research, and that research on fundamental problems generally precedes clinical applications. It is gratifying that such a thesis is so authoritatively defended at this very moment when general interest and financial support for medical research are growing. Research on problems with an immediate, "practical" application is not always the best nor the quickest way to solve the persisting needs of therapy. Research on the basic questions, even if they appear to be unrelated at the time to any practical application, is and will be the surest and most rewarding way to foster the progress of medicine.

It is to be hoped that the efforts Esther E. Lape and her staff devoted to compiling these volumes will be rewarded by a better understanding of the nature of the relationship between basic research and medical progress. It is fully appreciated by the workers in the field but it needs wider recognition among medical practitioners, agencies supporting medical research, and general public. Application of the advances made by medical research to the practical problem of pro-

viding adequate medical care calls for a maintenance of high standards of medical education, and the volume offers much food for thought and a challenge to medical educators.

We wish to emphasize here our complete agreement with the opinion expressed by Curtis Bok in his foreword to the book that "It is useless to discuss the administrative problem of distributing medical care and the economic problem of paying for it without reference to the central need of having a sufficient number of trained physicians capable of providing a type of medical care that can justify elaborate plans for distributing it and paying for it." It has been the sad personal experience of this reviewer that in some countries the agencies responsible for the organization of national programs of medical care seem to have paid little attention to its "quality."

The second volume deals with the present situation of medical research regarding nine major "unsolved" problems: cancer, infertility, arteriosclerosis, hypertension, rheumatic syndromes, tuberculosis, virus diseases, alcoholism, and schizophrenia. The topics are presented in the form of critical, constructive reviews of the literature and will be useful to those interested in these subjects.

The American Foundation deserves to be commended for this truly magnificent work which will no doubt have profound and long lasting influence on the development of medicine in all of its phases.

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Introduction to Demography. By MORTIMER SPIEGELMAN. xxi + 309 pp. The Society of Actuaries, Chicago, Ill. No price.

Writen as a textbook for actuarial students, this book will have a wide audience among all those who are interested in acquainting themselves with the problems and methods of demography. It is, so to speak, a running-mate to Hugh Wolfenden's *Population Statistics and Their Compilation*, published in 1954 by the University of Chicago Press.

At the outset, the author provides the historical background. He tells us that the first enumeration of a population was made in Babylonia 3,800 B. C. In the second and third chapters he explains the methods of collecting census data and vital statistics, and adjustments for errors.

Chapters four and five are concerned with measures of mortality and the construction of life tables. For intelligent reading of these chapters some previous knowledge of actuarial mathematics is required; however, the numerical examples used as illutrations ease the reader readily into the theoretical considerations. In chapter six the highly complex problem of mortality projection is considered. Here, too, previous knowledge is needed. This chapter is probably the best part of the entire work. In chapter seven Spiegelman deals with the perplexing problems of morbidity statistics. Chapters eight and nine analyze family formation and dissolution, fertility and reproduction.

The balance of the book comes to grip with census areas, internal and international migration (as it affects the United States and Canada) and the estimation of their effects. Some 30 pages are devoted to the analysis of the working population, including unemployment data. In the final chapter methods of population projections and estimates are explained and illustrated. There are some 35 pages of valuable references.

The data referred to by the author are limited mostly to the United States and Canada. Those of us who have concerned ourselves with research requiring population comparisons in different parts of the world would have liked to see a chapter on that subject included. In any case, Spiegelman's book will serve as an excellent reference work for vital statistics specialists abroad since he has included essentially everything that is worthwhile to know about the practices of the United States and Canada in this field.

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The Hypophyseal Growth Hormone: Nature and Actions. Edited by RICHMOND W. SMITH, OLIVER H. GAEBLER, and C. N. H. LONG. 576 pp. McGraw-Hill Book Co., New York, 1955. $12.00.

Advanced seminars, colloquia, or symposia have come to be increasingly popular with scientific men engaged in today's astounding overproduction of research reports in the standard journals of the world. Among agencies responsible for conducting these symposia must be mentioned the Ciba and Macy Foundations, UNESCO, the AAAS, and the so-called Laurentian Conferences. It is to the credit of the staff of the Henry Ford Hospital and the Edsel Ford Institute for

Medical Research that a symposium on the anterior hypophyseal growth hormone was conducted approximately a year ago and its deliberations published within a bare half year period—a record in promptitude.

Ever since the indispensability of the hypophysis for bodily growth was detected, and the prompt resumption of growth produced by the administration of anterior hypophyseal extracts, interest was given the central question of whether such reinvoked growth came from multiple essential constituents or hormones in the hypophysis or from a single specific substance—the so-called growth hormone. This has led to the isolation and purification of the substance designated as growth hormone (somatotropin). Preparations of it confer growth but are free of contamination with other anterior hypophyseal hormones.*

A host of unsolved problems as to the intervention of the growth hormone in normal and disordered metabolism are painfully evident in the present monograph, but this is just what every good survey should do. If exploration of the participation of the growth hormone in carbohydrate and protein metabolism is under way, similar effort as regards fat and even water and electrolyte metabolism has not received adequate attention. Specific metabolic synergisms and antagonisms of the growth hormone, especially its relations with ACTH, are not adequately treated. On the other hand, the chapters by Frank L. Engel on ketogenesis and by Honor B. Fell on hormonal effects in tissue are refreshing, and that on the comparative physiology of the pituitary by Alfred E. Wilhelmi perhaps the most provocative contribution in the book. The "Closing Remarks" by C. N. H. Long are themselves an admirable summary.

In conclusion, it may be said that a great body of scientific information as to the nature of the growth hormone and its participation in many phases of metabolism has now been secured and is here recorded. The monograph will hence be of inestimable value to research workers in this and related fields.

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* These results have not hitherto been applicable to cases of undergrowth in man, but the reason for this now appears to this reviewer to be clear and is to be sought in the report by Knobil and Greep (Anat. Rec., *124*: 320 (Feb. 1956)) of the successful provocation of increased growth in young monkeys by the administration of a somatotropic preparation made from monkey pituitaries whereas highly purified and potent somatotropin of bovine origin had proven inefficacious.

BOOK NOTICES

THE FRENCH BIBLIOGRAPHICAL DIGEST. Edited by The Cultural Division of the French Embassy. Part I. iii + 63 pp., Part II. iii + 88 pp. French Embassy, New York City, 1956. (no price). The Digest is intended as a bridge between French scientists and research workers abroad. The introductory section consists of a list of French periodicals, scientific societies and official agencies, and C. Lévi-Strauss' brief essay on "Anthropology in France Today." The core of the volume are abstracts of publications (1947-1955) in physical anthropology and prehistoric archeology (Part I) and in regional ethnography and archeology (Part II).

MENTAL DISORDERS IN LATER LIFE. Edited by Oscar J. Kaplan. ix + 508 pp. Stanford Univ. Press, Stanford, 1956. $7.50. A collection of 19 essays, first published in 1945 and now expanded and brought up to date, documenting the editor's conviction that "only through the close collaboration of psychiatrists, statisticians, physiologists, sociologists, and psychologists can we obtain the fullest measure of triumph over these afflictions which today account for more than a fourth of all first admissions to American mental hospitals."

PORTRAITS FROM MEMORY. By Richard B. Goldschmidt. ix + 181 pp. Univ. of Washington Press, Seattle, 1956. $3.50. Delightful essays which grew out of informal seminar talks on old times in zoology and on outstanding zoologists known by the author.

PRESENT-DAY PSYCHOLOGY. Edited by A. A. Roback. xiv + 995 pp. Philosophical Library, New York, 1955. $12.00. An outgrowth of the editor's *History of American Psychology* (1952), this collaborative survey consists of 5 parts labelled as topical departments (neural function, sensation, perception, etc.), branches (such as child, abnormal and social psychology), phases (including dynamic and clinical psychology), methods (statistics, interdisciplinary approach), and psychological borderlands (including psycholinguistics, esthetics, and psychology of religion). Though uneven and incomplete, the volume portrays a large number of facets of psychology's complex present.

RANK CORRELATION METHODS. By M. G. Kendall. vii + 1956 pp. Hafner Publ. Co., New York, 1955. $5.50. A revised and enlarged edition of the monograph on the analysis of ranked data, covering both practical applications and the underlying theory.

RESEARCH FILMS IN BIOLOGY, ANTHROPOLOGY, PSYCHOLOGY AND MEDICINE. By Anthony R. Michaelis. xvi + 490 pp. Academic Press, Inc., New York, 1955. $10.00. A unique "Handbook" of scientific cinematography. A critical discussion of the appropriate techniques precedes the accounts of their usefulness in dealing with a particular problem. Attention is drawn to quantitative evaluation and to possible new uses of the techniques. 1500 references.

SOCIETY AND HEALTH. By Walter E. Boek and Jean K. Boek. xviii + 301 pp. G. P. Putnam's Sons, New York, 1956. $4.50. Designed to aid medical-care personnel to understand human behavior in the framework of cultural authropology. Describes the process of acquiring culture and social differentiation within the U. S. cultural setting. The social structure of community leadership and of a hospital, the association between social factors and illness, and the changing scene in medical care are considered.

STARLING'S PRINCIPLES OF HUMAN PHYSIOLOGY. By Charles Lovatt Evans. ix + 1233 pp. (721 illustrations). Lea & Febiger, Philadelphia, 1956. $12.50. A revision of one of the leading textbooks in physiology, with a brief reference to growth and body composition (p. 812). Except for H. Hartridge's section on special senses, the weighty volume has the distinction of being edited by a single hand and mind.

FIFTH ANNUAL REPORT ON STRESS. Edited by Hans Selye and Gunnar Heuser. 815 pp. MD publ., New York, 1956. $20.00. Result of the continued efforts to record and systematize the world literature on stress. Some 5700 publications are considered in the present volume. In addition to the introductory material and Selye's review on "General physiology and pathology of stress," there are 9 special articles focussed largely on hormonal factors.

THE STRUCTURE AND FUNCTION OF SKIN. By William Montagna. 356 pp. Academic Press, New York, 1956. $8.80. A monograph on the microscopic anatomy of the skin, a versatile, heterogeneous organ in which the constituent suborgans have their own cycles of growth and activity. Integrates the findings made in the author's laboratory at Brown University with data from the literature. The fatty layer underneath the dermis is considered only incidentally.

TEXTBOOK OF MEDICAL PHYSIOLOGY. By Arthur C. Guyton. xiv + 1030 pp. W. B. Saunders Co., Philadelphia, 1956. $13.50. Writen expressly for the student, not as a combination of a textbook and a reference work for physiologists, it will be welcome by the audience to which it addresses itself.

TRACE ELEMENTS IN HUMAN AND ANIMAL NUTRITION. By E. J. Underwood. 430 pp. Academic Press, Inc., New York, 1956. $9.50. The first comprehensive survey of trace elements, including iron, iodine and fluorine, from the point of view of their nutritional significance to man and domestic animals.

TREATMENT OF THE CHILD IN EMOTIONAL CONFLICT. By Hyman S. Lippman. x + 298 pp. McGraw-Hill Book Co., Inc., New York, 1956. $6.00. Describes methods applying some features of child analysis to the treatment that can be offered in a medically oriented child guidance clinic. Stresses "total therapy" which requires the combined services of the members of the "psychiatric team, consisting of the caseworker, the clinical psychologist, the child psychiatrist, and recently, the group therapist. Others may also be involved in the therapy, depending on the needs of the child and his parents."

YEARBOOK OF ANTHROPOLOGY. 1955. Edited by William L. Thomas, Jr. xv + 836 pp. Wenner-Gren Foundation for Anthropological Research, New York, 1955. (no price). A selective report on major trends and accomplishments in the broad field of anthropology during 1952-1954. Readers of this journal may be especially interested in J. S. Huxley's guest editorial on "Evolution, cultural and biological" and W. W. Howells' "Universality and variation in human nature."

CURRENT ANTHROPOLOGY: A supplement to Anthropology Today. Edited by William L. Thomas, Jr. xii + 377 pp. The Univ. of Chicago Press, Chicago, 1956. $3.50 (paper) and $5.00 (cloth). Part I of the Yearbook (see above), reprinted as a separate volume.

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